



DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
WATER QUALITY MONITORING AND ASSESSMENT SECTION
WATERSHED INFORMATION SHEET

Lower Salt River & Mark Twain Lake Basin-07110007

Basin Description

The Lower Salt River basin lies in northeastern Missouri and flows east to its confluence with the Mississippi River about 20 miles southeast of Hannibal. The basin includes all of Mark Twain Lake, Lick Creek upstream of the lake and the watershed of the Salt River downstream of Mark Twain Lake. The basin is 794 square miles in area and the major tributaries include Spencer and Peno creeks. The largest reservoir in the basin is Mark Twain Lake with a surface area of 18,600 acres. There are four public drinking water reservoirs in this basin, including Mark Twain Lake that now serves as the drinking water supply for many small towns and rural water districts in northeastern Missouri.

Average annual rainfall ranges is 39 inches. Stream flow statistics for the basin are shown in Table 1.

Table 1. Stream Flow Statistics for the Lower Salt River Basin

Stream/Location	Wtrshed. Area (sq.mi.)	Period Of Record	Flow (cfs)				
			90 th Percentile *	Mean	Median **	10 th Percentile ***	7Q10 Low Flow+
Salt R. nr. Center	2,350	1980-2004	5,360	1,837	422	46	
Salt R. nr. New London	2,480	1922-2004	5,580	1,947	496	59	
Spencer Cr. nr. Frankford	206	1979-2004	222	155	23	1.2	0.0
Lick Creek at Perry	104	1979-2004	83	72.4	3.7	.03	

*Flow is less than this amount 90 percent of the time

**Flow is less than this amount 50 percent of the time

***Flow is less than this amount 10 percent of the time

+ The lowest average seven consecutive day flow that occurs with a recurrence interval of 10 years.

The Lower Salt River basin lies within the Dissected Till Plains physiographic province and is characterized by a mixture of hills and open plains. Fifty percent of the land is row crop, 26 percent is pasture and hay fields, 21 percent forest, and 3 percent open water.

Except for areas where streams have incised bedrock, the surface of the basin is glacial till overlain by loess. Glacial till is a mostly unsorted mixture of clay, sand, gravel and rock debris created and pushed southward into Missouri by the great glacial ice sheets. Loess is a windblown silt deposit. Depth of the till is highly variable but is generally less

than 50 feet. Loess deposits are 4-8 feet in depth. Despite the fact that streams incise limestone bedrock in much of the basin, there are only 22 known small springs and no sizeable ones. Isolated occurrences of upwelling of saline groundwater from the St. Peters sandstone have been noted and are believed to occur only where faulting has left vertical cracks in the overlying bedrock. Older bedrock of Devonian and Ordovician age forms a large portion of the Peno Creek watershed in the eastern portion of the basin, making this stream more Ozark in character. Peno Creek is one of only three streams north of the Missouri River in Missouri known to support Rock Bass, a fish typically found in cooler streams of the Ozark plateau.

The presence of the clayey till and the underlying shale and coal beds ensure that there is very little movement of water to the subsurface. Most water movement in the basin is through the surface stream network. Water that reaches the subsurface will resurface locally when a stream valley incises a confining aquatard (an impermeable layer). Since very little water infiltrates to the subsurface, streamflow can be very high during wet weather. For the same reason, base flows, streamflow sustained only by the re-emergence of groundwater into the stream, are very low during the intervening dry periods.

Water Quality Concerns

Acceptable water quality is defined by Missouri's Water Quality Standards [<http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf>]. Streams or lakes that do not meet these standards are considered "impaired." They may not be fit for certain uses such as swimming, drinking water supply or protection of fish and other aquatic life. Waters are considered "affected" rather than "impaired" if water quality changes are less serious and state standards are not exceeded. These standards also list more than 3,600 classified streams and more than 400 classified lakes in the state. A classified stream is one that is either a permanently flowing stream or one that may stop flowing in dry weather but still maintains large pools of water that support aquatic life. Unclassified streams are small tributaries to classified streams. They typically have flowing water only during wet weather and are dry for the remainder of the year.

Water Quality in Prairie Streams

<http://www.dnr.mo.gov/env/wpp/watersheds/info/wq-prairie-str.pdf>

Aquatic Habitat in Prairie Streams

<http://www.dnr.mo.gov/env/wpp/watersheds/info/aquatic-hab-prairie-str.pdf>

Point Source Pollution

Point source pollution is a discharge of wastewater from a single location such as a wastewater treatment plant. Wastewater treatment plants can serve industries, small businesses, subdivisions, mobile home parks, apartment complexes, or entire cities. Wastewater from residential sources such as subdivisions, apartments and mobile home

parks is often referred to as “domestic wastewater.” It primarily contains treated human wastes, food wastes and detergents. The primary pollutants of concern in domestic wastewater are the amount of organic matter, which is commonly reported as Biological Oxygen Demand (BOD), suspended solids, and ammonia. Industrial and commercial wastewater can be more complex and may contain, in addition to domestic wastes, heavy metals or man-made organic chemicals that can be potentially toxic. Discharges from most municipal wastewater treatment plants are usually a mixture of domestic and industrial/commercial wastewater. Most wastewater plant discharges are also typically high in nitrogen and phosphorus, two elements that act as fertilizers and can cause excessive algae growth in waters receiving these discharges.

There are 17 permitted domestic or industrial/commercial point sources that discharge a combined 1.42 million gallons per day (mgd) of treated wastewater into the waters of the Lower Salt River basin. There are 132 miles of classified streams in the basin. Only 0.1 miles (less than one tenth of 1 percent) are known to be affected or impaired by point source wastewater discharges. There are also 5.9 miles of unclassified streams affected or impaired by point source wastewater discharges. Wastewater discharges that affect at least 0.5 miles of their receiving streams include municipal discharges from New London, Bowling Green and Vandalia.

Wastewater Treatment

<http://www.dnr.mo.gov/env/wpp/watersheds/info/wastewater-treatment.pdf>

Nonpoint Source Pollution

Nonpoint source pollution occurs when pollutants enter bodies of water at points that are not well-defined and stable. Examples include the erosion of sediments or the entrance of polluted surface runoff or groundwater into lakes and streams. Locations of nonpoint source pollution are often widely dispersed and are difficult to identify or control. In the Lower Salt River basin, the most serious nonpoint problem is degradation of aquatic habitat. A total of 18 miles (14 percent) of classified streams in the basin are considered to have degraded aquatic habitat. The lack of infiltration of rainfall, when combined with local soil tillage and other land uses leads to a large amount of surface runoff during wet weather. This contributes to soil erosion and high levels of sediment deposition in streams. The quality of aquatic habitat is further impaired by removal of wooded riparian vegetation.

Storm water runoff in the Midwest can carry significant amounts of fertilizers, animal wastes, and pesticides into streams. Atrazine is an agricultural herbicide used on corn and grain sorghum that is commonly found in stormwater. Missouri’s water quality standards allow no more than 3.0 ug/l Atrazine in drinking water reservoirs as a long-term average. There are four reservoirs in the Lower Salt River basin that serve as drinking water supplies. Long term average Atrazine levels in these four reservoirs (prior to treatment at drinking water plants) is shown in Table 2. The state standard for the

maximum allowable level of Atrazine in a raw public water supply is 3 ug/l as an average. Long term Atrazine levels in Monroe City Route J Lake and Vandalia Lake exceed this standard. Average levels of a second herbicide, Cyanazine, exceeded Federal Drinking Water Health Advisory guidelines of 1 ug/l in Monroe City Route J Lake for some years, but use of that herbicide in the United States has been terminated.

Table 2. Long Term Average Atrazine Levels in Reservoirs of the Lower Salt River Basin (ug/l).

Reservoir	Average Raw Water
	Atrazine (ug/l)
Vandalia Lake	3.30
Monroe City Route J Lake	2.99
Monroe City South Lake	2.20
Mark Twain Lake	1.49

Finished drinking water is monitored regularly at all public supplies. Finished drinking water in Missouri has been found to meet state standards for pesticides. Levels of Atrazine in finished drinking water supplies may be significantly lower than the amounts found in the reservoirs, if the drinking water plants take measures to reduce Atrazine during the water treatment process. Federal regulations require the end of all Cyanazine use in 2002.

There have been no large studies of water quality in private wells in this portion of the state. However, studies of private wells in northern and western Missouri show that about one third of these wells exceed the drinking water standard for nitrate and about 2 percent exceed drinking water standards for pesticides. This contamination is often caused by local land use practices or surface contamination of the wellhead and does not represent widespread contamination of the underground aquifer. Deeper aquifers are protected from surface contamination by impermeable strata.

During warm weather when stream flows are low, livestock tend to gather in and around streams. The wastes they leave behind in the water contribute to nuisance algae growths, low levels of dissolved oxygen and elevated levels of ammonia and bacteria.

Water Quality Management

The department achieves water quality management of point source pollutants through the issuance and enforcement of wastewater discharge permits. These permits limit the amount of pollutants that can be discharged. All point source wastewater dischargers must obtain a permit and adhere to its discharge limitations. All permits require at least a level of treatment equal to national wastewater treatment standards. In situations where these national treatment standards are not adequate to protect the streams or lakes receiving these wastewater discharges, stricter permit limits that do protect these waters

are required. The permits require regular monitoring and reporting of discharge quality. The department also conducts regular inspection of wastewater treatment facilities and receiving waters.

Nonpoint source pollution is addressed through the state's nonpoint source management plan. This plan is a cooperative program between the Department of Natural Resources and other federal, state and local government agencies or organizations, local landowners and other interested citizens. The plan emphasizes addressing problems at the watershed level through the use of management practices that control nonpoint pollution. The most commonly supported practices are those that control soil erosion on agricultural and urban lands, improve quality and quantity of forage on grazing lands, protect riparian zones, and those that control runoff of animal manure, fertilizers and pesticides. The state nonpoint source management plan is a voluntary program that provides funds to help defray the cost of adopting management practices.

Since 1990, there have been four nonpoint source watershed projects in the basin. Three of these projects have been funded by state sales tax money earmarked for soil and water conservation and one project funded by Section 319 of the Federal Water Pollution Control Act. These projects treated more than 9,900 acres of land, comprising about 2 percent of the entire basin.

Table 3. Nonpoint Source Watershed Projects in the Lower Salt River Basin

Watershed Name	County	Project Date	Watershed Size (Acres)	Acres Treated	Percent of Watershed Treated
Straight Branch	Ralls	1993-97	4,784	3,551	74%
Hays Cr.	Ralls	1995-99	6,625	3,179	48%
Turkey Cr.	Ralls	1995-99	3,165	2,367	75%
Route J Lake	Ralls	1999-00	840	840	100%

The Missouri Department of Natural Resources monitors water chemistry and aquatic invertebrate communities at many locations in Missouri. The department also tracks the quality of domestic, industrial and storm water discharges. These monitoring activities provide information on water quality problems, such as their specific location, pollutants, sources and possible solutions. This information guides the management activities the department takes to protect water quality in Missouri.

Web links

US Geological Survey

<http://mo.water.usgs.gov/>

Kansas City District Corps of Engineers

<http://www.mvs.usace.army.mil/>

Mark Twain Lake

<http://www.mvs.usace.army.mil/MarkTwain/>

Missouri Department of Conservation

<http://www.mdc.mo.gov/fish/watershed/salt/contents/350cotxt.htm>

US Environmental Protection Agency

<http://www.epa.gov/region7/water/index.htm>